

REMARKS

Claims 58-84 are pending. Claims 58, 59, 63, 64, and 77-81 are amended.

Claims 58-84 were provisionally rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 52-95 of copending Application No. 09/891,612, claims 1-55 of US Patent No. 6, 855,929 or claims 1-60 of US Patent No. 6,593,152. Favorable reconsideration of these rejections is earnestly solicited.

Independent claim 58 has been amended to specify that a magnetic deflector for said beam separator is positioned outside of a vacuum wall. The claims of the copending application and of the cited patents do not render this feature obvious. See page 45, lines 4 and 5 of the present specification.

Independent claim 61 defines an electron beam apparatus using multi-beams. As stated in the prior response, claim 61 requires a “a spacing between irradiation points of the adjacent primary electron beams is set larger than an extending diameter of back scattered electrons on the sample.” The cited copending application and patents fail to render this feature obvious.

Independent claim 63 has been amended to specify “wherein the beam diameter and the beam current are adjusted by changing a brightness of the electron gun, and the electron beam apparatus has a plurality of particular patterns, one of which is selected and used to determine the beam diameter providing the maximum S/N ratio.” See page 107, lines 6-22 of the specification.

The claims of the cited copending application and patents fail to render these features obvious. In particular, in regard to the '152 patent, each of claims 21-23 defines that a ratio of a beam diameter to a line width is in a range, claims 24 and 25 defines that MTF is in a range, and claim 26 defines that D_i/d_i is in a range. None of these claims defines a beam current, while a beam current as well as a beam diameter is adjusted in the present invention.

Claim 77 has been amended to provide five additional steps in the method. Amended claim 77 and its dependent claims are not obvious over the claims of the cited copending application and patents.

For at least the above reasons, it is respectfully submitted that the amended claims are patentably distinct from the claims of copending Application No. 09/891,612, US Patent No. 6,855,929 and US Patent No. 6,593,152. Favorable reconsideration is earnestly solicited.

Claims 58-72 and 75-84 were rejected under 35 USC §103(a) as being unpatentable over Yamazaki and Petric. Favorable reconsideration of this rejection is earnestly solicited.

Neither Yamazaki nor Petric describes the above-noted limitations of claim 58. In particular, in Yamazaki, components for creating a magnetic field are provided in a region where electrodes 41a and 41b are positioned and are thus in a vacuum region, as indicated by hatching in Fig. 15.

In general, a magnetic deflector of a beam separator is required to deflect a beam

by several 100mrad while each of an axis adjustment deflector and a scanning deflector is required to deflect a beam by several mrad to several 10mrad. Therefore, the magnetic deflector of the beam separator is required to accomplish a large multiplication value of a current by a number of windings, and thus an electric resistance of the deflector is large, resulting in that an amount of calories emitted from the deflector is large. In addition, coils forming a magnetic deflector are generally covered by insulation films made of an organic material. Therefore, when the coils have a high heat, an amount of a hydrocarbon gas emitted therefrom is large.

In the present invention, since the magnetic deflector of the beam separator is located outside of the vacuum region through which an electron beam passes, such a hydrocarbon gas can be prevented from being emitted from the magnetic deflector. Accordingly, reliability of sample inspection such as defect detection on a sample can be improved using the electron beam apparatus according to the present invention.

In an electron beam apparatus using multi-beams as set forth in claim 61, setting a spacing between adjacent irradiation points of electron beams is very important in view of throughput and crosstalk. If the spacing is small, a number of beam spots in a range is large and hence throughput of inspection increases, while a crosstalk problem occurs.

In the present invention, since the spacing is set as defined in claim 61, back scattered electrons from one irradiation point are not irradiated on adjacent irradiation points, and thus the crosstalk problem cannot be caused.

Neither Yamazaki nor Petric describes the above limitations of claim 63. Therefore, claim 63 and its dependent claims 64-75 (excluding claims 73 and 74 which are not included in the obviousness rejection) are patentable over Yamazaki and Petric.

In particular, Yamazaki (column 6, lines 11-32) discloses control units 7-10 for controlling an acceleration voltage of a beam, an emission current, an optical axis, and a beam size on a sample on the order of $100\mu\text{m} \times 25\mu\text{m}$, respectively. However, Yamazaki does not describe any mechanism for controlling beam diameter and current to obtain a maximum S/N ratio of an electric signal associated with a secondary electron beam. Further, the Examiner seems to consider that “image blur” or “(beam current and) beam spacing relative to image blur” is equivalent, in view of the statement on page 12 of the Office Action. However, the image blur is a physical amount having a length dimension indicative of sharpness of an image, while an “S/N” ratio has no dimension and is not image blur or a beam spacing relative to image blur. Therefore, the statement of the Examiner is not reasonable.

In addition, it is often required in the same electron beam apparatus that a line and space pattern on a sample, lines and/or spaces of which are relatively large in width, should be inspected at a high speed, and on the other hand, a line and space pattern on a sample, lines and spaces of which are relatively small in width, should be inspected with high accuracy.

In the present invention, a plurality of particular patterns such as line and space patterns are provided, and one of the patterns is selected on the basis of a line and space pattern to be inspected, and the adjusting mechanism uses the selected pattern to determine the beam current

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and diameter providing the maximum S/N ratio while brightness from an electron gun is being changed.

Therefore, the present invention can deal with the above cases (large size and high speed inspection and small size and high accuracy inspection) in one electron beam apparatus.

Independent claim 77 has been amended to set forth additional steps. Amended claim 77 and its dependent claims are not taught or suggested by the cited art.

For at least the foregoing reasons, the claimed invention distinguishes over the cited art and defines patentable subject matter. Favorable reconsideration is earnestly solicited.

Should the Examiner deem that any further action by applicants would be desirable to place the application in condition for allowance, the Examiner is encouraged to telephone applicants' undersigned attorney.

If this paper is not timely filed, Applicants respectfully petition for an appropriate extension of time. The fees for such an extension or any other fees that may be due with respect to this paper may be charged to Deposit Account No. 50-2866.

Respectfully submitted,

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